

**BEFORE
THE PUBLIC SERVICE COMMISSION OF
SOUTH CAROLINA**

DOCKET NOS. 2019-224-E and 2019-225-E

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| In the Matter of: |) |
| |) |
| South Carolina Energy Freedom Act (House |) |
| Bill 3659) Proceeding Related to S.C. Code |) |
| Ann. Section 58-37-40 and Integrated |) |
| Resource Plans for Duke Energy Carolinas, |) |
| LLC and Duke Energy Progress, LLC |) |
| |) |

SURREBUTTAL TESTIMONY OF KEVIN LUCAS

ON BEHALF OF

THE CAROLINAS CLEAN ENERGY BUSINESS ASSOCIATION

Revised April 23, 2021

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I. INTRODUCTION AND SUMMARY

Q1. PLEASE STATE FOR THE RECORD YOUR NAME, POSITION, AND BUSINESS ADDRESS.

A1. My name is Kevin Lucas. I am the Director of Rate Design at the Solar Energy Industries Association (SEIA). My business address is 1425 K St. NW #1000, Washington, DC 20005.

Q2. ARE YOU THE SAME KEVIN LUCAS THAT SUBMITTED DIRECT TESTIMONY IN THIS PROCEEDING?

A2. Yes, I am.

Q3. WHAT IS THE PURPOSE OF YOUR SURREBUTTAL TESTIMONY?

A3. The purpose of my surrebuttal testimony is to respond to the rebuttal testimony Duke Energy Carolinas ("DEC") and Duke Energy Progress ("DEP") (collectively, "Duke" or "the Company") witnesses Glen Snider and Matthew Kalembe. I focus on three primary topics: (1) the importance of the Commission's decision in *this* proceeding; (2) modeling performed by Synapse Energy Economics, Inc. ("Synapse"), which further corroborates the points made in my direct testimony; and (3) the Company's natural gas forecast methodology. I also discuss several issues related to cost and operational assumptions used in the Company's modeling.

Q4. DOES YOUR LACK OF SURREBUTTAL TESTIMONY ON OTHER TOPICS INDICATE AGREEMENT WITH THE COMPANY'S OR OTHER PARTIES' POSITIONS ON THOSE MATTERS?

A4. No, it does not.

Q5. PLEASE SUMMARIZE YOUR SURREBUTTAL TESTIMONY.

1 A5. The decision that the Commission issues in this case will set the precedent for Duke's IRPs
 2 under Act 62 and must be given proper weight. Duke's overall position is that its IRP,
 3 despite numerous questionable modeling assumptions and an insufficient risk analysis, is
 4 "good enough" and should be approved now and fixed later. Duke is essentially asking the
 5 Commission to approve this IRP not based on what was filed and litigated in this docket
 6 but to instead consider and incorporate potential future fixes that may or may not
 7 satisfactorily address the deficiencies. This is contrary to the standard of review
 8 established by Act 62, which requires the Commission to determine whether the proposed
 9 IRP "represents the most reasonable and prudent means of meeting the electrical utility's
 10 energy and capacity needs as of the time the plan is reviewed," based on the criteria
 11 established in the statute.¹ To ensure that a utility's IRP has met this standard, the
 12 Commission is further authorized to approve, deny, or modify a utility's proposed IRP.²

13 Duke also claims that the "priorities of operational reliability and customer
 14 affordability do not appear to be shared by the Advocacy Groups, which instead advocate
 15 for or against specific technologies, depending upon the mission of the organizations that
 16 they represent."³ Putting aside Duke's own corporate incentives, Duke's assertion
 17 regarding other parties is unsupported and incorrect. It is also directly rebutted by
 18 modeling performed by Synapse, demonstrating that Duke's resource adequacy and hourly
 19 energy needs can be reliably met through a portfolio which does not require new natural
 20 gas generation, reduces greenhouse gas emissions 78% more than Duke's Base Case with

¹ S.C. Code Ann. § 58-37-40(C)(2).

² *Id.* § 58-37-40(C)(1).

³ Snider Rebuttal at 8. The "Advocacy Groups" as defined by Duke include Carolinas Clean Energy Business Association, South Carolina Coastal Conservation League, Southern Alliance for Clean Energy, Upstate Forever, Sierra Club, Natural Resources Defense Council, and Vote Solar.

1 Carbon Policy scenario, and saves Duke's customers \$7.2 billion over the modeling
2 period.⁴

3 Duke offers little rebuttal to my testimony showing the significant impact of the
4 Company's unreasonable natural gas forecast methodology on its IRP. Instead, Company
5 witness Glen Snider focuses his rebuttal on historic avoided cost proceedings in North
6 Carolina and claims that the purpose of my testimony is not to address the very real and
7 important impacts of the natural gas forecast in the current IRP proceeding, but instead to
8 surreptitiously attempt to position the solar industry for "significant monetary gains" based
9 on hypothetical results of future dockets.⁵ Aside from being mistaken about the purpose
10 of my testimony, Mr. Snider fails to address the reality that an unreasonably-low natural
11 gas price forecast could cause the model to favor new natural gas over other resources such
12 as additional renewables and storage, placing the risk of stranded asset and fuel price
13 changes squarely on the Company's customers while providing Duke's shareholders with
14 a bloated capital investment plan for unnecessary fossil generation.

15 In addition to the three main issues above, my surrebuttal addresses the Company's
16 flawed method of pricing 20-year PPAs in its modeling. I also respond to the Company's
17 misinterpretation of my testimony regarding two-hour batteries, showing that two-hour
18 storage can indeed be a valuable and cost-effective resource to meet important system peak
19 needs. I also rebut the Company's response to my minimax analysis and show why the
20 Company's preference for ORS's methodology does not best reflect the soundest scenario

⁴ Exhibit KL-S-1, Surrebuttal Testimony of Rachel Wilson, Exhibit RW-2 "Synapse Report: Clean, Affordable, Reliable: A Plan for Duke Energy's Future in the Carolinas" ("Synapse Report").

⁵ Snider Rebuttal at 68.

1 planning approach. Finally, I respond to the Company's rebuttal testimony on battery and
2 solar cost and operational assumptions.

3 **Q6. WHAT ARE THE OVERALL RECOMMENDATIONS OF YOUR SURREBUTTAL TESTIMONY?**

4 A6. My overall recommendations are the same as the ones I made in my direct testimony. First,
5 and foremost, as noted above, the Commission is required by law to determine whether
6 Duke has presented the "most reasonable and prudent" means for meeting its resource
7 needs. The statutory language clearly and unequivocally contemplates and requires the
8 selection of a single plan that meets this standard. Duke has presented six different resource
9 plans to the Commission without clearly indicating which of the six it considers to be the
10 "most reasonable and prudent," although in response to an ORS discovery request Duke
11 now seems to suggest that it believes its Base Case without Carbon resource plan should
12 be deemed "the most appropriate plan" in the absence of a requirement to select a single
13 "most reasonable and prudent plan."⁶

14 Even if the Commission determines that Duke is not required to state which of its
15 six plans it considers to be most reasonable and prudent, the Commission itself may not
16 abdicate making that decision. I continue to believe that the Commission requires
17 additional information to make this required decision in an informed manner and that
18 Duke's current modeling incorporates fundamentally flawed inputs that cannot produce
19 reasonable results, but to the extent that the Commission's decision is made on the current
20 record, I believe for the reasons stated in my testimony that of the options presented by
21 Duke the Base Case with Carbon is the most reasonable and prudent plan.

⁶ Snider Rebuttal at 39.

1 Generally speaking, the most prudent resource planning path for Duke to follow is
2 to transition to zero carbon emissions as rapidly as possible to enable the broader
3 decarbonization of the economy. Duke agrees at the corporate level and has set an
4 enterprise-wide goal of net-zero emissions by 2050, but this timeline is out of step with the
5 urgency of the situation and increasingly misaligned with public policy proposals.⁷
6 Unfortunately, Duke's IRP, if approved, would lock ratepayers into a gas-heavy generation
7 track as "the most reasonable and prudent" plan, despite the overwhelming financial and
8 regulatory risks associated with this approach. As discussed below, Duke's responsive
9 testimony only confirms that it has underestimated the costs of its gas-build plans.

10 In addition, I continue to recommend that the Commission rule on the Company's
11 IRP based on the requirements established by Act 62 and reject Duke's arguments that
12 issues can and should be instead kicked down the road. As Duke would have it, there are
13 no consequences that flow from the Commission's decision on its IRP, which Duke views
14 as simply a "snapshot in time" in an ongoing and endless planning process. Nothing could
15 be further from the truth. It is critically important that this Commission have accurate
16 resource planning information now so that it can make important decisions about the state's
17 energy future, including whether and how to exercise its statutory authority to require
18 additional renewables procurement by Duke. Duke clearly does not welcome being subject
19 to such direction by the Commission, and therefore seeks to make it difficult if not
20 impossible for the Commission to carry out its statutory responsibilities.

21 Importantly, the 2021 IRP Update may not be reviewed in a fully litigated
22 proceeding, because, under Act 62, it is only intended to be an update to a utility's base

⁷ See, e.g., President Biden's proposal to decarbonize the electricity sector by 2035 and the entire economy by 2050. <https://www.cenews.net/stories/1063728877>

1 planning assumptions. By default, Act 62 does not provide the comprehensive process
 2 applicable to this proceeding to review IRP Updates, but relies primarily on ORS to review
 3 and report on the results of any base planning adjustments. Although the Commission could
 4 order additional review of an IRP Update, it has not stated its intention to subject Duke's
 5 next IRP Update to such procedures. Duke's next full IRP is not required to be filed under
 6 Act 62 until Fall 2023, putting any decision in that docket into Summer 2024.⁸ This in turn
 7 means procurement decisions supported by the outcome of that IRP will not likely occur
 8 before 2025, with projects not coming online until 2026 or later – five years from now.
 9 This is simply too long for Duke to proceed under an approved IRP that wrongly assumes
 10 that a massive buildout of new gas generation is the most reasonable and prudent approach
 11 for South Carolina businesses and residents.

12 II. THE COMMISSION MUST DETERMINE WHETHER DUKE'S IRP AS FILED IS
 13 THE MOST REASONABLE AND PRUDENT PLAN.

14 **Q7. WHAT IS DUKE'S GENERAL RESPONSE TO INTERVENORS' RECOMMENDATIONS CALLING**
 15 **FOR CHANGES IN THE COMPANY'S IRP IN THIS PROCEEDING?**

16 A7. I would classify the Company's position as claiming its filing is "good enough" to be
 17 approved and fixed later. As Company witness Glen Snider states, "[a]djustments to the
 18 Companies' IRPs can much more readily and cost-effectively be made on a going-forward
 19 basis."⁹ Mr. Snider continues:

20 The Companies are in the midst of an unprecedented, long-term transition
 21 from a legacy fleet that included coal generation towards a new mix of
 22 cleaner generation, including renewables, battery storage systems and

⁸ Duke has indicated that it will follow North Carolina's current two-year IRP schedule in South Carolina as well. However, there are legislative activities in North Carolina that may have implications to this schedule. The only requirement under South Carolina statute is the three-year cadence in Act 62.

⁹ Snider Rebuttal at 7.

efficient natural gas across the Companies' systems. While this is the Companies' first IRP proceeding under Act 62, this transition is necessarily a marathon, not a sprint, and the Companies and the Commission must prudently and judiciously plan for and execute this transition in a way that protects system reliability and customer affordability. Every portfolio and every resource carries risk, and only the Companies' objectively- and holistically-developed resource plans adequately address such risks.¹⁰

Q8. WHAT IS YOUR RESPONSE TO THIS POSITION?

A8. While I agree with the focus on protecting system reliability and customer affordability, I disagree that the best approach in a time of significant energy technology and policy flux is slow-motion decision-making that looks into the rearview mirror rather than proactively adapting to what plainly lies ahead. At a corporate level, Duke Energy acknowledges an imperative to decarbonize the electricity sector and the entire economy, and the pace needed to stay competitive and compliant in the foreseeable future requires decisive, forward-looking plans. The solution set for the electricity sector – including increasing levels of renewables and energy storage – is at this point well-established, and Duke should be making every effort to rapidly integrate more of these resources into its grid in the most cost effective and reliable manner possible.¹¹ Building large amounts of costly new natural gas infrastructure is not only unnecessary but also exposes Duke's customers to future regulatory risk, including stranded assets and fuel price volatility that renewables deployment can minimize and avoid.

Whether one personally agrees with the pressing need to rapidly decarbonize the economy is beside the point: the marketplace is increasingly aligning with this position, and the implications for South Carolina's economic competitiveness are material. South

¹⁰ Snider Rebuttal at 7.

¹¹ See e.g. <https://newscenter.lbl.gov/2021/01/27/getting-to-net-zero-and-even-net-negative-is-surprisingly-feasible-and-affordable/>

1 Carolina job-producing companies in Duke's territory have adopted carbon reduction
 2 goals, with Michelin targeting zero carbon emissions from its plants by 2050,¹² General
 3 Electric targeting carbon neutrality by 2030,¹³ and the BMW Group aiming to reduce its
 4 emissions 80 percent from 2019 levels by 2030.¹⁴ Other leading companies such as
 5 Google, Apple, Amazon, Walmart, GM, Johnson & Johnson, and nearly 300 others have
 6 committed to 100% renewable energy.¹⁵ Some of these companies are making access to
 7 100% renewable energy a prerequisite to expanding into new markets. Public opinion is
 8 also aligning, with voters across the political spectrum expressing support for clean energy
 9 development.¹⁶

10 Fortunately, as I will discuss below, "more renewables and storage" and "system
 11 reliability and customer affordability" are not mutually exclusive goals. Duke can and
 12 should be accelerating towards a known solution set of low-cost new renewables and
 13 storage while avoiding the risk to its customers of its proposed natural gas buildout.

14 **Q9. PLEASE REVIEW THE PRIMARY REASONS THAT DUKE'S IRP MUST BE REJECTED.**

15 A9. As I discussed in my direct testimony, Duke has failed to identify a single plan as its
 16 candidate for the "**most** reasonable and prudent means of meeting the electrical utility's
 17 energy and capacity needs as of the time the plan is reviewed."¹⁷ Duke claims that its
 18 "pathways" approach meets the Act 62 test "as a total plan that can adapt to changing
 19 standards, technology and policy decisions in the future."¹⁸ However, the most

¹² <https://www.michelin.com/en/news/michelin-takingaction-for-the-planet/>

¹³ <https://www.ge.com/renewableenergy/about-us/carbon-neutral>

¹⁴ <https://www.bmwgroup.com/en/responsibility/group-wide-environmental-protection.html>

¹⁵ <https://www.there100.org/re100-members>

¹⁶ <https://www.conservativeenergynetwork.org/wp-content/uploads/2021/01/201002-Clean-Energy-National-Online-Survey-Interview-Schedule.pdf>

¹⁷ S.C. Code Ann. § 58-37-40(C)(2) (emphasis added).

¹⁸ Snider Rebuttal at 37.

1 straightforward reading of the Act 62 language implies a single, “most” reasonable and
2 prudent plan, not a portfolio of plans with disparate resource mixes, asset retirement, and
3 transmission buildout.

4 The preferred plan that the Commission ultimately approves will serve as the input
5 into other proceedings including avoided costs, competitive procurement of solar and
6 energy storage resources, new unit certification, and demand-side management (“DSM”) program planning. These proceedings require a specific set of resources to be assumed and
7 input values to be used, not a portfolio of potential resource mixes that would produce
8 different results in production cost modeling.

9 Nor is Duke's claim that its "total plan" can “adapt to changing standards”
10 meaningful. While *any* plan, whether identified individually or as part of a multi-resource
11 plan package, can be amended to attempt to comply with changing standards, technology,
12 and policy decisions in the future , retaining flexibility while also reducing risk and
13 maintaining reliability and cost-effectiveness can be better accomplished through
14 recommendations included in my testimony.

15
16 **Q10. EVEN IF ACT 62 DID NOT REQUIRE THE COMPANY TO PRESENT A SINGLE RESOURCE PLAN**
17 **TO THE COMMISSION FOR EVALUATION, HAS DUKE PROVIDED SUFFICIENT INFORMATION**
18 **TO ALLOW THE COMMISSION TO WEIGH THE MERITS OF ITS SIX PORTFOLIOS?**

19 A10. No. Duke has failed to provide the Commission with sufficient information to make this
20 determination among the six portfolios. Duke’s analysis on the operational, policy, and
21 technology advancements required to implement each portfolio’s resource mix is lacking.
22 It appears from Duke’s own timelines that small modular reactors and pumped hydro
23 facilities – key pillars of several of Duke’s plans – will not be online in sufficient time to

1 meet several of its portfolios.¹⁹ Duke's narrow focus on comparing the Present Value
 2 Revenue Requirement ("PVRR") between its various portfolios fails to consider risk
 3 factors related to natural gas delivery and cost. Absent more robust information that Duke
 4 has not provided, the Commission will be unable to make a determination of the most
 5 reasonable and prudent plan based on the record in this docket.

6 **Q11. DESPITE THIS, WHY DOES DUKE PROPOSE THAT THE COMMISSION APPROVE ITS IRP IN**
 7 **THIS CASE?**

8 A11. Duke's primary argument that the Commission should not reject or modify its proposed
 9 IRP to address its acknowledged deficiencies is that Duke will fix these problems later.
 10 Duke promises to resolve several problems in the IRP Update it will file in the fall, and
 11 claims that it would be procedurally inconvenient to extend the current docket while also
 12 filling the IRP Update. This argument fails for two reasons.

13 First, it is inconsistent with Act 62. Act 62 provides that the purpose of annual IRP
 14 Updates is to provide "an update to the electric utility's base planning assumptions relative
 15 to its most recently accepted integrated resource plan," such as forecasted load, changes in
 16 retirement dates of assets, and renewable energy forecasts.²⁰ These updates are reviewed
 17 only by the Office of Regulatory Staff ("ORS"), which in turn submits a report to the
 18 Commission "providing a recommendation concerning the reasonableness of the annual
 19 update."²¹ The Commission may then "accept the annual update or direct the electrical
 20 utility to make changes to the annual update that the commission determines to be in the
 21 public interest."²² Act 62 does not explicitly provide intervenors (other than ORS) an

¹⁹ Lucas Direct at 14.

²⁰ S.C. Code Ann. § 58-37-40(D)(1).

²¹ S.C. Code Ann. § 58-37-40(D)(2).

²² S.C. Code Ann. § 58-37-40(D)(2).

1 opportunity to fully review and comment on annual Updates. Act 62 *does* give the
 2 Commission the right to approve, modify, or deny a utility's proposed IRP during a "full"
 3 IRP proceeding such as this one, and gives intervenors the right to comment on any
 4 modified IRP. It would be inappropriate and inconsistent with this statutory scheme to
 5 allow the utility to defer significant corrections to its IRP to annual updates, which are
 6 subjected to limited scrutiny. Duke should not be exempted from this statutory scheme
 7 simply because revising its IRP would be burdensome or inconvenient for the Company.

8 Although the Commission doubtless has the discretion to allow greater
 9 participation by other stakeholders in annual IRP updates (such as the right to intervene,
 10 take discovery, and present testimony), it has not yet indicated that it will do so with respect
 11 to Duke's next update. But to the extent that the Commission were to permit Duke to defer
 12 any changes to its IRP Update – which again, I believe is not appropriate – it should at a
 13 minimum clarify that intervenors in this proceeding would have the right to fully review
 14 and comment on those changes.

15 Second, approving Duke's deficient IRP based on the promise of future corrections
 16 is inconsistent with the standard of review under Act 62. Under the statute, the
 17 Commission must decide whether Duke's IRP "represents the most reasonable and prudent
 18 means of meeting the electrical utility's energy and capacity needs **as of the time the plan**
 19 **is reviewed.**"²³ The plan is currently being reviewed in this docket; what Duke may or
 20 may not do in the future is immaterial. For example, Duke claims that it is sufficient to
 21 delay incorporating the new federal investment tax credit ("ITC") extension until its 2021
 22 IRP Update,²⁴ despite the fact that this change will have a material impact on the cost, and

²³ S.C. Code Ann. § 58-37-40(C)(2) (emphasis added).

²⁴ Snider Rebuttal at 44.

1 thus modeled optimization results, associated with new solar and solar plus storage
2 facilities.²⁵

3 Duke's approach requires this Commission to ignore data that is today known now
4 to be correct or reasonable. The ITC extension is current and binding law; failing to
5 incorporate its impact in a full IRP proceeding is *per se* arbitrary and unreasonable. Duke
6 also proposes several other future modeling assumption updates, including shifting to a
7 100% single-axis tracking ("SAT") assumption for future Tranche 2 CPRE and a
8 consideration of shifting all future solar plus storage projects to 100% SAT.²⁶ Switching
9 to 100% SAT was recommended in my testimony and thoroughly supported with market
10 data as of the end of 2019, before Duke began its modeling in this case.²⁷ These changes
11 could and should have been incorporated into the original IRP filing and the resource
12 adequacy results in this proceeding, would likely have produced higher summer and winter
13 capacity credits for solar and storage. The availability of less-expensive solar and storage
14 that can contribute more to capacity needs and produce more energy is a material change
15 and should be considered and evaluated in determining the most reasonable and prudent
16 plan in *this* IRP.

17 **Q12. IS DUKE'S CLAIM CORRECT THAT REVISING THE CURRENT IRP IS UNREASONABLE GIVEN**
18 **THE TIMING OF THE IRP UPDATE?**

19 **A12.** No. For example, Duke witness Matthew Kalembe states:

20 If the Companies were to incorporate this change in policy into a modified
21 IRP, a Commission order on a modified IRP in these dockets would not be
22 expected until December 2021/January 2022. This timing makes a modified
23 IRP incorporating these changes obsolete in light of the September 2021

²⁵ Under IRS guidelines, storage equipment paired with solar also qualifies for the federal ITC.

²⁶ Kalembe Rebuttal at 33.

²⁷ Lucas Direct at 49.

1 IRP Update, which will be available before the 2020 IRPs are ever
2 approved.²⁸

3 The Company's argument on this point is not valid. The Commission must carry out its
4 statutory obligation to approve the most reasonable and prudent plan in a fully-litigated
5 IRP proceeding (which the IRP Update is not) under Act 62. If it rejects or requires
6 modification to an IRP plan as the result of this evaluation, that is an appropriate outcome
7 that is specifically contemplated by Act 62. Whether or not this causes the annual IRP
8 update to become outdated does not alter the Commission's duty in this docket. Under
9 Duke's position, the Commission would not be able to take an action other than approving
10 an IRP as other authorized actions available to it (*i.e.*, rejecting or requiring modifications)
11 would necessarily conflict with annual IRP updates. This is clearly not what Act 62
12 envisioned.

13 **Q13. WHAT IS YOUR RECOMMENDATION WITH RESPECT TO THIS ISSUE?**

14 A13. This is the first Duke IRP to be decided under Act 62 and, as such, it has substantial
15 precedential importance. Delaying the correction of key inputs until the IRP Update or
16 even until the projected Fall 2023 IRP cannot render the current IRP Act 62-compliant.
17 The Commission should carefully weigh the evidence that was presented here and base its
18 decision on those facts. While I appreciate the fact that Duke agreed to correct certain
19 modeling assumptions such as the mix of SAT in the future, these updates are reasonable
20 – or already law – today and should be incorporated into modeling in this case.

21 I continue to recommend that the Commission reject the Company's IRP and
22 require material modifications in this proceeding. This should include a requirement to
23 select a single resource plan and incorporating material updates to modeling assumptions

²⁸ Kalembe Rebuttal at 8.

I recommended in my direct testimony such as the extension of the ITC and changes in the SAT mix for future projects, among others. I also recommend a more accelerated renewable and storage buildout supported by the Synapse modeling. Shifting up the deployment of these resources will save Duke's customers money while substantially reducing CO₂ emissions. I discuss the specific buildout recommendations in the next section.

III. ADDITIONAL MODELING SHOWS RELIABILITY AND CUSTOMER AFFORDABILITY ARE ATTAINABLE WITH NO NEW NATURAL GAS ASSETS.

Q14. WHAT DID YOU PREDICT IN YOUR DIRECT TESTIMONY WOULD BE THE MODELING RESULT OF MAKING THE ADJUSTMENTS TO DUKE'S INPUT VARIABLES?

A14. In my Direct Testimony, I predicted that:

If Duke were to make these updates to its modeling, it is likely that cost-optimal portfolios will feature earlier coal retirements, lower natural gas builds, and higher and earlier solar, solar plus storage, and standalone storage deployment. These updated portfolios will enable Duke's customer to reap the benefit of the federal ITC extension while jumpstarting Duke's progress towards its own 2050 net zero goals.²⁹

Q15. HAS ANY MODELING BEEN PERFORMED TO SUPPORT THIS PREDICTION?

A15. Yes. Synapse performed and submitted modeling in the Duke's North Carolina IRP proceeding.³⁰ As discussed more fully in the surrebuttal testimony of Rachel Wilson of Synapse, submitted today on behalf of CCEBA and other intervenors, two portfolios were modeled using EnCompass software.³¹ The first portfolio, "Mimic Duke," used most of Duke's

²⁹ Lucas Direct at 111.

³⁰ See Initial Comments of the North Carolina Sustainable Energy Association and the Carolinas Clean Energy Business Association on Duke Energy Carolinas, LLC and Duke Energy Progress, LLC's Integrated Resource Plans, NCUC Docket No. E-100, Sub 165 (Mar. 1, 2021).

³¹ Surrebuttal Testimony of Rachel Wilson (Apr. 15, 2021), Exhibit RW-2 "Synapse Report: Clean, Affordable, Reliable: A Plan for Duke Energy's Future in the Carolinas" ("Synapse Report").

1 inputs and assumptions from its Base Case with Carbon Policy to establish a base case and
2 calibrate the EnCompass model. The second, "Reasonable Assumptions," reflected several
3 changes in key input assumptions such as renewable and battery costs and DSM.³²

4 **Q16. HOW WERE NATURAL GAS PRICES FORECASTED IN THIS MODEL?**

5 A16. Both scenarios above used EnCompass's natural gas forecast with adjustments. This
6 differed from Duke's assumption in two ways. First, the EnCompass model did not assume
7 lower costs associated with Marcellus shale gas were available (*i.e.*, there was no basis
8 differential applied to some of Duke's new or future natural gas plants), which is consistent
9 with the lack of transportation options from that area to Duke's territory. Second, Synapse
10 included a \$1.50/MMBTU cost adder to secure firm supply to any new natural gas
11 combined cycle ("NGCC") units.³³ These two changes resulted in a natural gas price
12 forecast that was of a similar shape to Duke's, but shifted upwards in cost.

13 **Q17. WAS THE NATURAL GAS FORECAST USED IN THE SYNAPSE MODELING IDENTICAL TO THE**
14 **FORECAST YOU RECOMMENDED?**

15 A17. No, it was not. The purpose of the Synapse modeling was to show that utilizing a limited
16 number of more reasonable assumptions than Duke's would yield an alternative portfolio that
17 was cheaper and cleaner than the base case while retaining the same reserve margins and
18 avoiding any loss of load hours. Further, by not including a basis differential and including
19 a reasonable firm fuel transport adder, the natural gas figures that Synapse used were higher
20 than those used by Duke, offsetting some of the impact of too-low natural gas prices that
21 ORS witnesses identified.³⁴

³² Synapse Report at 11.

³³ Synapse Report at 12.

³⁴ See Section IV, *infra*.

1 **Q18. WHAT ARE THE HIGH-LEVEL RESULTS OF THE SYNAPSE MODELING?**

2 A18. First, Synapse's modeling demonstrated that the Reasonable Assumptions portfolio with more
3 renewable energy and battery storage and no new natural gas was able to meet Duke's
4 "priorities of operational reliability and customer affordability." Second, this Reasonable
5 Assumptions portfolio was \$7.2 billion or 9.5% less costly than the Mimic Duke case over the
6 planning period. Third, the Reasonable Assumptions portfolio would produce half of the CO₂
7 emissions between 2021 and 2035 as the Mimic Duke scenario, hitting the 70% reduction goal
8 by 2027, and positioning the Company much closer to its long-term 2050 goal of net-zero
9 emissions. Finally, the Reasonable Assumptions portfolio meets 100% of customer load,
10 including on difficult-to-manage winter mornings.³⁵ Ms. Wilson discusses these results in
11 more detail in her testimony.

12 **Q19. What interconnection limits did Synapse include in its modeling?**

13 A19. The model was limited to 1,500 MW of PV between 2021 and 2029 and 1,800 MW of PV
14 in 2030 and beyond, and to 100 MW, 200 MW, and 300 MW at various years for onshore
15 wind. Battery storage was limited to 1,660 in 2021, increased to 1,900 MW in 2027, and
16 to 1,960 MW in 2030 and beyond.

17 These figures are higher than the current interconnection limits of 500 MW and 900
18 MW between DEC and DEP in the base and high renewables cases, respectively. Duke
19 has not provided any basis on which to predict what its ability to interconnect new
20 generation will be over the planning period. But the arbitrarily low limits Duke sets in its
21 model (which are lower than Duke's actual past performance) are unreasonable and not
22 reflective of improvements that are being made to the interconnection process.

³⁵ Synapse Report at 18-21.

Incorporating the higher but still reasonable limits used in the Synapse model will allow the model to consider higher levels of annual renewables deployment, while preventing it from selecting portfolios that are simply impracticable.

Q20. WHEN DOES THE SYNAPSE MODEL BEGIN TO ADD NEW RENEWABLE GENERATION?

A20. The model begins building solar and onshore wind in 2023 and battery storage in 2026. Annual additions, show in Figure 1 below, are relatively modest in the early years before ramping up in earnest in 2026 and beyond. Notably, unlike Duke, the Synapse modeling did not “force in” any renewables. It began with 3,925 MW of existing PV generation on the DEC and DEP systems as of 2021 and added all additional resources as a result of the modeling optimization.

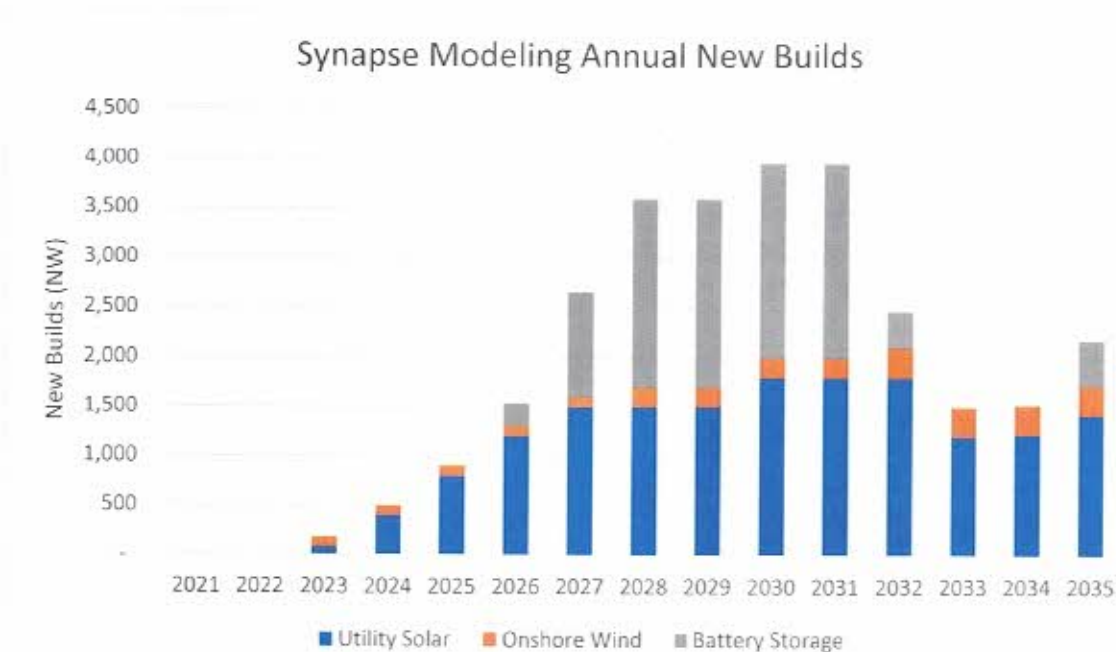


Figure 1 - Synapse Modeling Annual Builds

Q21. IF THE COMMISSION WERE TO ADOPT AN IRP BASED ON A SIMILAR RESOURCE MIX, WOULD YOU ADVOCATE FOR THIS EXACT BUILD OUT SCHEDULE?

A21. No, not exactly. The results above are based on a model run that included reasonable limits to annual builds but could be improved based on real-world constraints.³⁶ Further, the figures above do not reflect builds that are already under contract as part of existing programs (e.g. Duke's "Designated" category) or planned under existing programs (e.g. Duke's "Mandated" category). Figure 2 below compares the cumulative solar installation under Duke's Base Case with Carbon Policy (Designated, Mandated, and Undesignated) and the Synapse Reasonable Assumptions modeling.³⁷

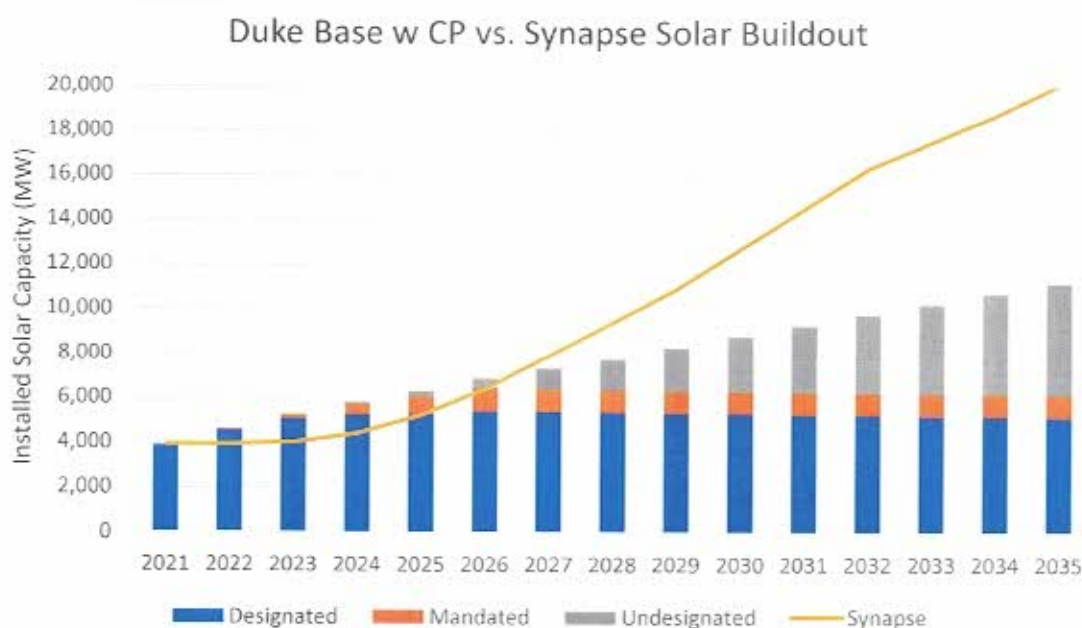


Figure 2 - Solar Buildout Comparison

Specifically, I would recommend that if Duke were to follow a path towards this 2035 resource mix target, it begin adding solar and storage earlier. This approach would allow Duke's customers to benefit from the ITC extension for both standalone solar and

³⁶ The model was limited to 1,500 MW of PV between 2021 and 2029 and 1,800 MW of PV in 2030 and beyond, and to 100 MW, 200 MW, and 300 MW at various years for onshore wind. Battery storage was limited to 1,660 in 2021, increased to 1,900 MW in 2027, and to 1,960 MW in 2030 and beyond.

³⁷ Duke figures based on Kalembe Rebuttal Exhibit 1.

solar plus storage systems while also alleviating interconnection challenges associated with the rapid modeled increase beginning in 2027. Further, by installing storage sooner, the Company will gain operational experience in that technology that it notes it is currently lacking.³⁸ This experience will be valuable as it begins to ramp up storage installations in the latter part of this decade. Figure 3 below proposes a more moderated build-out strategy that ensures that the minimum cumulative capacity in any year is at least as high as the Synapse modeling while moderating annual increases in capacity.³⁹

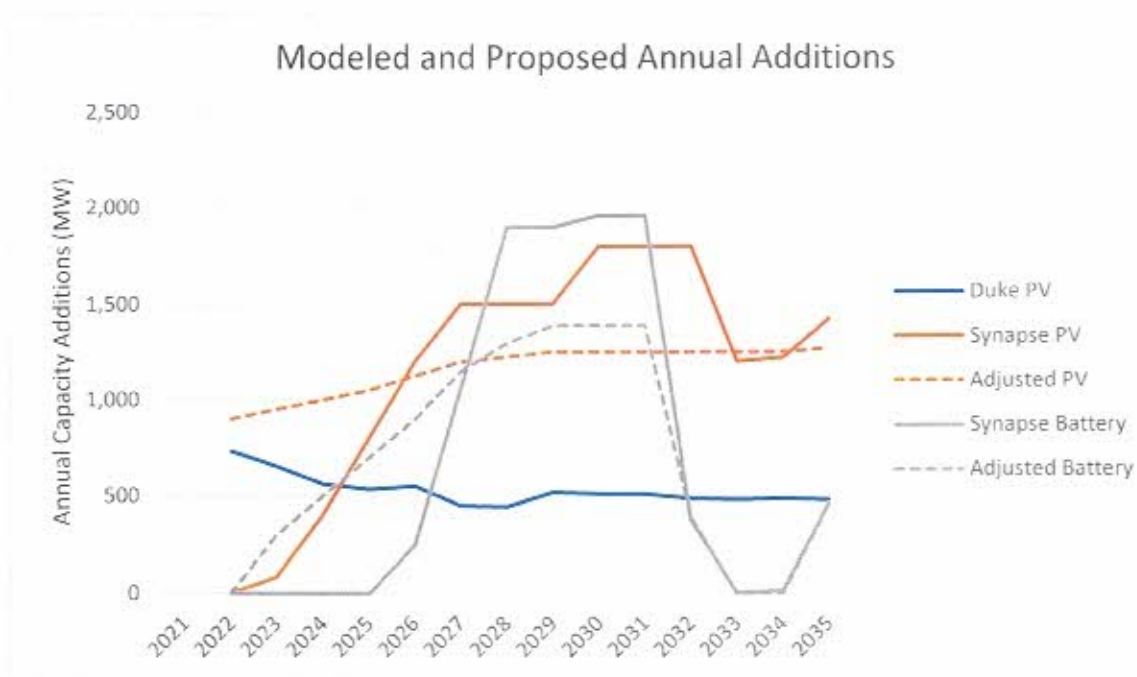


Figure 3 - Modeled and Proposed Annual Additions

Q22. HOW DOES THIS BUILDOUT COMPARE TO DUKE'S FIGURES?

³⁸ Exhibit KL-8, Duke Response to SCSBA's Second Request for Production to DEC/DEP ("SCSBA RFP 2") (producing Duke response to DR NCSEA 5-2) (confidential).

³⁹ Under the "adjusted" schedules, the total amount of solar and storage are at least as much as what was called for in that year under the Synapse modeling. This ensures that the reliability constraints that Synapse demonstrated based on given levels of solar and battery storage capacity and energy contributions will also be met under the "adjusted" schedule. See Exhibit KLS-3 for details on the annual build in both schedules.

1 A22. The renewable capacity buildout figures in the Synapse model are higher than those in
2 Duke's Base case, which is not surprising given the interconnection limits that Duke
3 imposed in its modeling. Duke's witness Mr. Kalemba testifies that its annual
4 interconnection limits (500 MW and 900 MW for the combined DEC and DEP territories
5 in the base and high renewable scenarios, respectively) are reasonable because "significant
6 portions of the DEC and DEP systems are identified as 'constrained' meaning that
7 significant transmission upgrades are required in order to add additional generation."⁴⁰ But
8 while these constraints on the transmission system may increase the cost of required
9 upgrades and the amount of lead time it takes to construct individual projects, they do not
10 substantially reduce the rate at which new projects can be studied.

11 The sizable cost savings that are obtainable through advancing the renewable and
12 storage buildout strongly suggest that the construction of new transmission upgrades to
13 enable additional buildout would be fully justified. Moreover, as Mr. Kalemba
14 acknowledges, the Commission has only recently approved Duke's interconnection "queue
15 reform" proposal, the primary purpose of which is to make Duke's interconnection process
16 more efficient.⁴¹ Furthermore, Duke's capacity to study generator interconnections (on a
17 MW basis) should increase substantially in the coming years, not only because of queue
18 reform, but also because the projects in the interconnection queue consist increasingly of
19 fewer large-scale transmission-interconnection projects rather than many small-scale
20 distribution-interconnected projects. For a variety of economic and policy reasons, it is
21 clear that the future of Duke's system will involve a dramatic ramp up of new renewable
22 and battery storage projects, and it must be able to meet this challenge in a timely manner.

⁴⁰ Kalemba Rebuttal at 35-36.

⁴¹ Kalemba Rebuttal at 37.

1 **Q23. IF THE COMMISSION WERE NOT TO ORDER UPDATED MODELING IN THIS CASE, WOULD**
 2 **YOU STILL RECOMMEND THAT IT ORDER DUKE TO PROCEED AS RAPIDLY AS POSSIBLE**
 3 **TOWARDS A SIMILAR BUILDOUT AS YOU DESCRIBE ABOVE?**

4 A23. Yes. The Synapse model shows that incorporating more renewable energy and battery
 5 storage can meet the reliability needs of Duke's system while delivering substantial savings
 6 over the planning period. It is also clear that state and federal policy, Duke's corporate
 7 goals, and commercial and individual interests are rapidly aligning towards more
 8 aggressive decarbonization. These factors, combined with modeling that supports the
 9 viability of this transition, should be sufficient for the Commission to select the direction
 10 to go and begin moving rapidly down that path. Issuing an immediate and sizable
 11 procurement for renewable energy and batteries is sufficiently justified by the record, even
 12 if the Commission does not require additional modeling to be performed.

13 **IV. DUKE'S REBUTTAL TESTIMONY FAILS TO REMEDY THE MAJOR FLAWS IN**
 14 **ITS NATURAL GAS FORECAST, WHICH IS CRITICAL TO THE IRP.**

15 **Q24. PLEASE PROVIDE AN OVERVIEW OF DUKE'S REBUTTAL TESTIMONY ON ITS NATURAL GAS**
 16 **FORECAST METHODOLOGY.**

17 A24. Duke witness Snider provides rebuttal testimony on its natural gas forecast methodology.
 18 Mr. Snider begins by summarizing ORS's expert witness reports on this topic.⁴² He then
 19 turns to a history of avoided cost proceedings in North Carolina to provide "background
 20 and context for the Companies' natural gas forecasting methodology."⁴³ Finally, Mr.
 21 Snider address my direct testimony,⁴⁴

⁴² Snider Rebuttal at 62.

⁴³ Snider Rebuttal at 66.

⁴⁴ Snider Rebuttal at 68.

1 *A. ORS is Critical of Duke's Natural Gas Forecast Methodology*

2 **Q25. WHAT DID ORS AND ITS EXPERTS FIND REGARDING DUKE'S NATURAL GAS FORECAST**
 3 **METHODOLOGY AND ASSUMPTIONS?**

4 A25. ORS and its experts identified numerous issues with the Company's forecast methodology.
 5 For instance, ORS found that:

- 6 • Duke's prices forecasts "are consistently lower than the consensus forecasts" in the
 7 near-term.⁴⁵
- 8 • "There are a few noticeable issues regarding the Company's forecast including the
 9 fact that it is rather flat for about ten years."⁴⁶
- 10 • "The Company appears confident that based on actual market quotes it can lock in
 11 its gas supply for its entire system for the next ten years, which in our experience
 12 would be unusual for an electric utility to do."⁴⁷
- 13 • "We point these concerns out because low gas price forecasts could result in
 14 indicating that natural gas-fired resources are comparatively less expensive than
 15 they otherwise would be relative to other resource alternatives."⁴⁸
- 16 • "The Company discusses that 5 and 10-year observable market curves are at \$2.39
 17 and \$2.53, which is consistent with the Company's base forecast, however, as
 18 discussed above, it is not clear that the Company would or even could in fact lock
 19 in its entire gas supply for the next ten years."⁴⁹

⁴⁵ ORS Sandonato Direct at 49.

⁴⁶ ORS Sandonato Direct at 50.

⁴⁷ ORS Sandonato Direct at 50.

⁴⁸ ORS Sandonato Direct at 50.

⁴⁹ ORS Sandonato Direct at 51.

- “In Appendix F, the Company also discusses its need for ‘additional upstream firm interstate transportation service to support existing and future natural gas generation.’ With the cancellation of the Atlantic Coast Pipeline (“ACP”) in July 2020, the Company has no active projects to expand its interstate gas supply.”⁵⁰
- “Without the ACP, the Company notes it will not have any direct access to Marcellus and Utica shale basins of West Virginia, Pennsylvania, and Ohio natural gas supply.”⁵¹

Put together, ORS found significant flaws in Duke’s natural gas forecast and assumptions. It correctly concluded that Duke’s near-term forecast is lower than most other sources, appropriately questioned whether Duke could actually contract for its supply for ten years at those prices, and pointed out the massive risks associated with a buildout that would require new interstate pipeline capacity to be built and reserved. While I disagree with the notion that these flaws do not render the forecast results “unreasonable,” ORS’s critique nonetheless supports my testimony and recommendation that the Commission order Duke to revise its gas projections.

B. Duke has Repeatedly Ignored the Directive of the NCUC

Q26. PLEASE PROVIDE A SUMMARY OF THE “BACKGROUND AND CONTEXT” THAT THE COMPANY PROVIDED ON ITS NATURAL GAS FORECAST METHODOLOGY.

A26. Mr. Snider discusses the history of recent avoided cost proceedings in North Carolina, highlighting a North Carolina Utility Commission (“NCUC”) ruling that requires utilities to align forecasts used in their IRP and avoided cost proceedings.⁵² He then focuses on

⁵⁰ ORS Sandonato Direct at 51.

⁵¹ ORS Sandonato Direct at 51.

⁵² Snider Rebuttal at 66.

1 the “overpayment risk” associated with PURPA contracts that were priced based on
 2 avoided costs⁵³ before making the baseless claim that the primary purpose of my testimony
 3 in this case was to influence the setting of avoided costs in another docket (and another
 4 state) that would result in the “solar development community [to] be poised for significant
 5 monetary gain.”⁵⁴ Mr. Snider suggests in his testimony that the NCUC has generally
 6 approved of Duke’s gas price forecasting methodologies, when in fact the opposite is true.⁵⁵

7 **Q27. HAS THE NCUC APPROVED DUKE’S NATURAL GAS FORECAST METHODOLOGY?**

8 A27. No. The NCUC has repeatedly rejected Duke’s natural gas forecasting methodology and
 9 its over-reliance on near-term market data. The Company’s initial foray into using ten
 10 years of market data followed by a five-year transition to a fundamentals-based forecast
 11 occurred in the 2014 North Carolina avoided cost proceeding.⁵⁶ The NCUC rejected
 12 Duke’s approach and directed the Company to revert to its methodology used in its 2014
 13 IRP, which used only five years of market prices.⁵⁷ It also directed Duke to proposed
 14 changes in its natural gas forecast methodology in IRP proceedings, not avoided cost
 15 proceedings.⁵⁸

16 Duke proposed such a change in its 2015 NC IRP Update report, and again in its
 17 full biennial 2016 NC IRP. The NCUC found the forecast methodology was “appropriate”
 18 for those matters but went on to note that “the Commission’s acceptance of fuel forecasting
 19 methodologies in the present IRP docket shall not be precedent for or in any manner

⁵³ Snider Rebuttal at 67.

⁵⁴ Snider Rebuttal at 68.

⁵⁵ Snider Rebuttal at 66-68.

⁵⁶ N.C.U.C. Docket No. E-100, Sub 140

⁵⁷ *Order Establishing Standard Rates and Contract Terms for Qualifying Facilities*, Docket No. E-100 Sub 140 (N.C.U.C. Dec. 17, 2015) (2014 Sub 140 Order”) at 27.

⁵⁸ 2014 Sub 140 Order at 28.

1 prejudice decisions to be made in the pending avoided cost proceeding in Docket No. E-
 2 100, Sub 148.”⁵⁹ The NCUC also reversed its position on where changes in methodology
 3 should be proposed, determining “that specific issues related to fuel forecasting
 4 methodologies employed by the utilities, are best resolved in the context of the avoided
 5 cost proceeding.”⁶⁰

6 In the 2016 North Carolina avoided cost proceeding, Duke again proposed using
 7 ten years of market prices with a transition to fundamentals-based forecast in year 11.⁶¹
 8 The NCUC disagreed with this approach and found that “[i]t is appropriate to require DEC
 9 and DEP to recalculate their avoided energy rates using forward natural gas prices for no
 10 more than eight years before using fundamental forecast data for the remainder of the
 11 planning period.”⁶²

12 In the 2018 avoided cost proceeding, Duke again proposed to use the same natural
 13 gas forecast methodology.⁶³ And again, the Commission disagreed with this approach and
 14 declined to alter its previous (Sub 148) directive: “the Commission finds that it is
 15 appropriate to require DEC and DEP to continue to calculate their respective avoided
 16 energy costs using forward contract natural gas prices for no more than eight years before
 17 using fundamental forecast data for the remainder of the planning period.”⁶⁴

18 Despite two orders on this exact issue where the NCUC found that it was reasonable
 19 to require DEC and DEP to use *no more* than eight years of market prices before

⁵⁹ *Order Accepting Integrated Resource Plans and Accepting REPS Compliance Plans*, Docket No. E-100, Sub 147 (N.C.U.C. June 27, 2017) (“Sub 147 Order”) at 39.

⁶⁰ *Id.*

⁶¹ N.C.U.C. Docket No. E-100, Sub 148 (N.C.U.C. Oct. 11, 2017) (“2016 Sub 148”) Order at 70.

⁶² 2016 Sub 148 Order at 7.

⁶³ N.C.U.C. Docket No. E-100, Sub 158.

⁶⁴ *Order Establishing Standard Rates and Contract Terms for Qualifying Facilities*, Docket No. E-100, Sub 158 (N.C.U.C. Apr. 15, 2020) (“2018 Sub 158 Order”) at 59.

1 transitioning fully to a fundamentals-based forecast, Duke has for the third time ignored
 2 that directive and filed a forecast in this docket that utilized not eight, but fifteen years of
 3 market prices.⁶⁵

4 **Q28. DID DUKE EVER COMPLY WITH THE NCUC'S DIRECTIVES?**

5 A28. Eventually. After years of failing to adhere to the NCUC's directives regarding its natural
 6 gas forecasts, Duke finally made a filing in the 2020 Sub 167 avoided cost docket
 7 conforming to the eight-year use of market prices.⁶⁶ However, in this docket and in the
 8 parallel IRP dockets in North Carolina, Duke has relied on a contrary methodology.

9 *C. The Natural Gas Forecast Methodology is Critical to this IRP*

10 **Q29. WHY IS THE NATURAL GAS PRICE FORECAST IMPORTANT IN THE CONTEXT OF THE IRP?**

11 A29. As Duke and other utilities transition away from coal generation, the pressing question is
 12 what assets should replace the capacity and energy served by the retiring coal units. DSM
 13 programs such as energy efficiency and demand response should be incorporated as
 14 robustly as possible, but the rest of the resource gap will need to be filled with some
 15 combination of replacement capacity, be it commercially-available natural gas generation,
 16 battery storage, or renewable energy generators.⁶⁷

17 How this resource gap is filled is one of the fundamental questions to be answered
 18 in this proceeding. The scenarios evaluated calculate the costs of different resource
 19 combinations and their production costs, which are driven overwhelmingly by the price of

⁶⁵ Duke's methodology continues to utilize market prices in years 11 to 15 as it transitions to the fundamentals-based forecast. Lucas Direct at 66.

⁶⁶ Duke Energy Carolinas, LLC and Duke Energy Progress, LLC's Joint Initial Statement and Exhibits NCUC Docket No. E-100, Sub 167 at 19.

⁶⁷ While other non-commercial resources such as small modular nuclear reactors, green hydrogen-powered gas turbines, or fossil plants with carbon capture and sequestration may play a role in the future, Duke recognizes that these resources are unlikely to be commercially available and economically feasible in the near term.

1 fuel. If one uses a natural gas forecast that is too low, the modeling will tend to favor the
2 development of natural gas resources. This potential issue was identified by ORS's
3 witnesses, who noted that "low gas price forecasts could result in indicating that natural
4 gas-fired resources are comparatively less expensive than they otherwise would be relative
5 to other resource alternatives."⁶⁸

6 While the IRP does not provide automatic approval of individual resources (*i.e.*,
7 Duke would still need to get a CPCN for any generation that was part of an approved IRP),
8 this proceeding will send a strong signal about the most appropriate direction for Duke to
9 pursue and will have implications for other issues before this Commission, like the timing
10 and size of competitive procurement programs. Approving a plan that includes a massive
11 natural gas build out, based in part on an unreasonably low natural gas price forecast, will
12 de-prioritize or eliminate the near-term opportunity to cost effectively and reliably utilize
13 zero-carbon renewables and energy storage as part of the "most reasonable and prudent"
14 plan.

15 **Q30. ARE THERE RISKS ASSOCIATED WITH A LARGE BUILD OUT OF NEW NATURAL GAS**
16 **GENERATION?**

17 A30. Yes, there are several risks, most of which will be borne by Duke's customers. The first is
18 a reliability and cost risk arising from uncertainty about Duke's ability to secure firm
19 natural gas transportation to its current and potentially expanded fleet of gas generating
20 facilities. The Company has admitted that it needs more pipeline capacity than it currently
21 has to meet its growing natural gas needs, and that without the recently-cancelled ACP it
22 does not have a plan to access currently low-cost Marcellus or Utica basin gas.⁶⁹ If Duke

⁶⁸ ORS Sandonato Direct at 50.

⁶⁹ ORS Sandonato Direct at 51.

1 cannot deliver gas to its generating units, Duke's customers will be paying for generators
2 that are not able to provide energy and capacity. Further, Duke's reliance on non-firm
3 contracts for its peaker units may cause supply issues and pricing risk during periods of
4 high demand, as was tragically demonstrated during the February 2021 electricity crisis in
5 Texas.

6 Additionally, while Duke is able to earn a return on and return of capital expended
7 for the construction of new natural gas units, Duke's customers bear the cost (and risk)
8 associated with fuel expenses. In fact, over the lifetime of a high capacity factor NGCC
9 unit, the fuel and operating expenses dwarf capital recovery costs. Figure 4 below is taken
10 from a 2017 IRP for DTE Electric in Michigan, showing the relative portion of cost from
11 various generating technologies broken down by capital, O&M, and fuel expenses on a
12 \$/MWh basis.⁷⁰ While DTE's natural gas assumptions may not match Duke's exactly, and
13 the renewable cost values are out of date, it is instructive to note that roughly 80% of
14 lifecycle costs of the NGCC come from fuel and O&M, expenses that are recovered from
15 Duke's customers.

⁷⁰ Michigan Public Service Commission Case No. U-18419, K.J. Chreston Exhibit A-4 at 177.

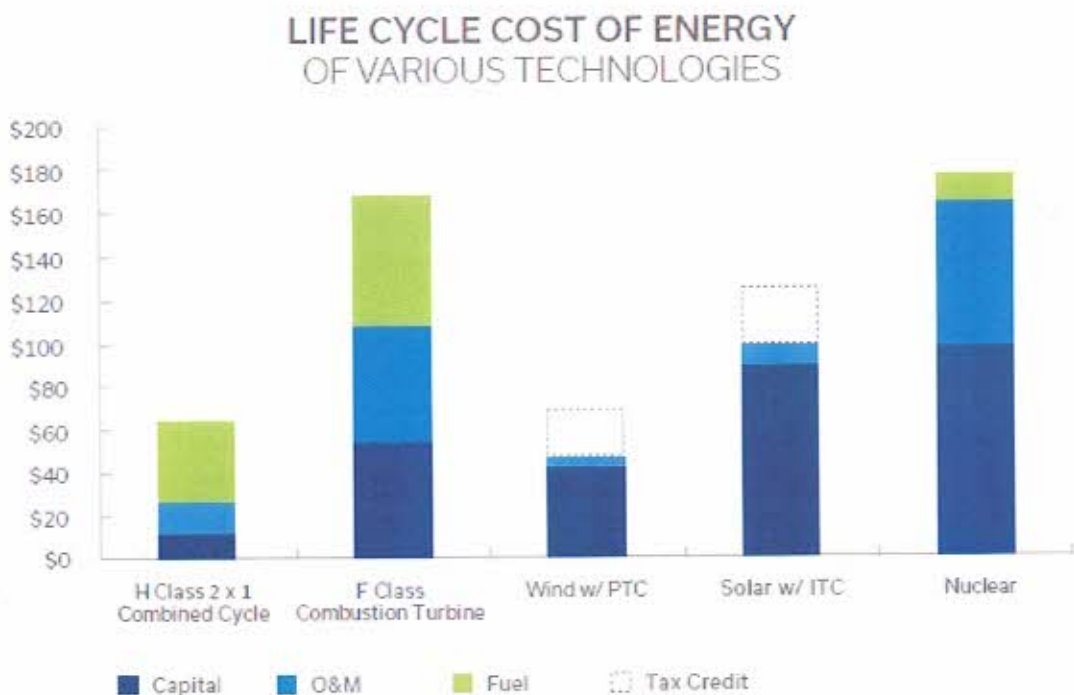


Figure 4 - DTE Life Cycle Cost of Energy

Duke's plans to build more natural gas units expose its customers to these costs and risks. By contrast, renewable energy has no variable fuel costs and its fixed O&M costs are a relatively small fraction of the total cost. The vast majority of solar costs are known up front and are not subject to fluctuations in fuel costs over the life of the project.

D. The "Risk of Overpayment" is Speculative and is Already Being Addressed

Q31. IS DUKE'S CLAIM THAT SOLAR QUALIFIED FACILITIES RECEIVE OVERPAYMENT VALID?

A31. No. Duke presents a calculation of possible overpayment that is highly speculative based on existing PURPA contracts (most of which were signed in the 2014-2017 time period) and the delta between the approved avoided costs and Duke's then-current forecast.⁷¹ Of course, the accuracy of this calculation is wholly dependent on the accuracy of Duke's

⁷¹ Direct Testimony of George V. Brown, Docket No. 2019-185-E (Aug. 14, 2019) at 16.